Lesions of primary visual cortex typically result in retinotopically localised scotomas.

A female patient, AG, with monocular (right eye) vision, is presented with unexplained visual field loss. At the age of 8, her left eye was surgically removed, because of a retinoblastoma, and an artificial eye has been supplied since then.

Medical profile

Visual field tests revealed a lower altitudinal hemianopia which is slowly progressing over the time to recently involve also the upper temporal quadrant.

Fundus examination (retina and optic disc), electroretinogram and optical coherence tomography of the retina have all demonstrated normal and there is no evidence of any macroscopic cortical lesions and cortical visual evoked potentials.

Behavioural performance

Fine shape discrimination shapes ratio discrimination Dot Lattices RFP texture surfaces Figure Ground Segmentation Object in isolation Embedded figure detection

Low performance on the Leuven Perceptual Organization Screening Test demonstrated severe deficit in perceptual grouping and integration.

Participants & Stimuli

2 scans 1 yr apart
AG x n=3 healthy, controls at each visit
fMRI retinotopic mapping, eccentricity, hrf
sMRI high-resolution T1

fMRI methods

Analysis

ImPulse model
Dumoulin & Wandell,2008* Schwarzkopf et al.,2014 *
model prediction

Perceptual discrimination

References

Discussion

AG suffers from unexplained visual loss, demonstrated in multiple perimetry tests, with a clockwise constant progression of the loss through the upper left visual field and a moderate anticlockwise progression of the loss in the right hemifield. In agreement with this, she shows great deficiency in behavioral tests assessing mid level visual perception. Surprisingly, her retinotopic maps appear normal. Her visual field loss therefore does not respect the vertical meridian of the visual field corresponding to the lateralization of early retinotopic areas in visual cortex. Clinical evidence for retinotopically organized scotomas following damage to the striate cortex is established for over a century. However, evidence of perimetrically identifiable loss following damage to extra-striate visual cortex is in most instances attributed to damage to underlying optic radiation. The only exception of two cases of homonymous quadrantanopia follows damage to V2/V3. The unimpaired progression of AG’s scotomas across the vertical meridian may suggest dysfunction in higher visual areas where receptive fields are known to extend well into the ipsilateral visual field. This is consistent with her general lack of perceptual grouping which may be mediated by higher regions.